

# A Short on Tree Biology

Trees and other plants have often been called factories because they convert light energy into chemical energy. Through the process of photosynthesis, leaves capture solar energy by converting carbon, hydrogen, and oxygen into complex sugars. One of these complex sugars is cellulose, the main ingredient of wood fiber. Although a complete knowledge of photosynthesis is not essential to understanding how trees grow, it is important to realize that, in theory, the faster and more efficiently a tree carries on photosynthesis, the faster it will grow. Availability of light and water are two factors that can be controlled by harvesting.

When a portion of the growing stock is removed, the photosynthetic material is reallocated to the remaining trees. In a young stand, it is usually only a matter of 5 to 10 years before the crowns of residual trees grow into the spaces left by those taken out. Trees are principally composed of four main parts: roots, stem, branches, and leaves. Other specialized structures, like flowers and seeds, develop periodically for purposes of reproduction. However, virtually all of the important physiological processes in trees involve one or more of the four main parts.

## **Roots**

About 20% of the mass of a forest-grown tree is devoted to roots. In addition to anchoring the tree, roots gather mineral nutrients, take up water, and store the products of photosynthesis. Forest tree roots are much more extensive than they appear. For example, the root system of a sugar maple may extend as much as 2 to 5 times beyond the spread of its crown. Most of these roots, known as fine or feeder roots, are within a few inches of the soil surface. Though the fine roots may account for only 14% of the total root mass, 80% of the total root length is in fine roots. Consequently, roots are everywhere in the forest and the ones that are most sensitive to damage are also the most susceptible.

## **Stem**

The main stem usually makes up about 60% of a tree's weight. It supports the branches and leaves and serves as the main plumbing system, with vessels to transport water and nutrients up to the leaves and with other cells to transport photosynthesis sugars to living tissue throughout the tree. The growing portion is only a thin layer of cells surrounding the main stem. Each year this thin sheath of cells puts down a new layer of sapwood. The rate at which it does this determines how fast a tree grows in girth.

## **Branches & Leaves**

A tree's branches support leaves in a configuration that maximizes light availability or that protects them from excessive exposure on harsh sites. Branches also serve as the second-order plumbing of the main stem. The leaves carry on photosynthesis and exchange important gasses, such as oxygen and carbon dioxide, with the atmosphere. Combined, branches and leaves make up about 20% of the tree's total weight. Although all trees have roots, stems, branches, and leaves, the form of each of these components differ among species - and within a species in some cases. Some characteristics, such as the size and shape of leaves from the top of the crown versus those on shaded lower branches, even differ on the same tree. For this reason, leaf size and shape are said to be plastic because they are characteristics that mold themselves to the circumstances. This is one of the reasons why learning trees solely by their leaves is so unreliable and frustrating.

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